An Inaugural Dissertation on Tetanus.

Submitted to the examination of
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provost (pro tempore)
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by
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Tetanus is a disease incident to all Climates, but found to prevail more frequently in those which are warm, and in the warmest seasons.

In the United States we have known it to happen at all seasons, but we have most reason to apprehend its attacks, in the summer and Autumnal Months; and particularly when damp and cold nights succeed to warm days. Doctor Cullen tells us, that tetanus is not confined to any age, sex, temperament, or complexion.

We will however find it oftener attack the robust, vigorous, and healthy than the relaxed and de-bilitated; and males oftener than females. The blacks in the west Indies, doctor Moseley informs us are more subject to it than the white inhabitants, which he ascribes to an excess of irritabilety in the

negroes

negroes; But I am inclined to think with doctor Hillary, and others, that its frequency among them is owing to their being much more exposed to the causes which produce it; as bad clothing, going barefoot, frequent wounds received in their various oc-
-cupations, exposure to an intense sun, and then a custom which they frequently have, of plunging into some cool stream, while bathed in sweat, and debilitated with hard labour. This we are also told is a frequent cause of tetanus in the East Indies.

Nor is this disease confined to the human species, for Horses have been afflicted with it.*

The length of time from receiving the injury until the symptoms super-
-vene is various, depending in a great measure upon the season, habit

* Rush, Moseley

habit, and the cause. In India when sudden cold has been applied to the body labouring under a state of considerable debility, spasm has been induced in an instant; and so violent as to cause death in half an hour;* In general however, when cold is the occasional or exciting cause the symptoms make their appearance about twelve hours after exposure to it, and frequent=ly on the second, third, fourth and fifth day.† When the disease is occasioned by wounds the symptoms appear after the tenth day, rarely sooner, and frequently not before the fourteenth,‖ and they have appeared on the, eighteenth, twentieth and even fortieth day after the accident,‡ long after the wound is

* Girdlestone
† " Cullen, Chalmers, Rush & Hillary
‖ Hillary ‡ Rush

is intirely healed. Doctor Moseley says that he never found after a wound or operation in the West Indies, that there was any time until the patient was entirely well, that exempted him from the insutt of this disease.

Most authors have given distinct names to the different distortions of the body in this complaint; as opisthotonos when the muscles of the neck and spine act in bending the body backwards, like a bow. Emprosthotonos when the body is bent in the contrary direction, the chin drawn towards the breast. Trismus or locked jaw when the temporal and Maseter muscles are affected, fixing the teeth firmly against each other. And when an universal spasm

affects

affects all the muscles of voluntary motion, in which the flexors and extensors exert an equal force, keeping the body in a straight and fixed posture, the disease is called Tetanus.

I shall consider, and speak of every modification under this general term, as the same treatment will be found requisite in every form which has been enumerated.

The symptoms in tetanus, from whatsoever cause it arise, are found to be so constant and uniform, that the disease cannot be mistaken for any other. The patient first complains of general uneasiness attended with a slight pain in the head, while the muscles about the neck and those destined to move the lower jaw become a little rigid and painful; this rigidity gradually increases, together with the pain, until

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a constant spasm of the masseter and temporal muscles, causes the lower jaw to be firmly fixed against the upper. During the progress of these symptoms an uneasy sensation is felt near the root of the tongue, which increases so as to impede, and oftentimes to prevent deglutition. These symptoms are uniformly accompanied with a violent pain shooting from near the scrobiculus cordis, towards the back; and as this pain becomes more violent, all the symptoms are aggravated. The spasms now rapidly seize upon the muscles in the neighbourhood of those already affected, until all the muscles, depending upon the will, are brought into sympathy; and the unhappy sufferer although, incapable of infusing the smallest portion of command into any muscle, will retain the entire use of his reasoning

faculties

faculties, until the system is nearly exhausted by the violence of the disease.

These are the symptoms which generally accompany Tetanus, but oftentimes injuries done to tendinous parts, from punctures, bruises &c. are directly followed with intense pains, and convulsions, in the muscles of the limb; and of the whole body; and compleat tetanus, can only be prevented by instantly dilating the puncture; or amputating the bruised member, if it be a finger or a toe.

Pain is not a constant and invariable symptom even in the most violent attacks. I have known says, doctor Moseley, people in the tetanus with the sweat running off them from the agonizing pulling of the muscles, who have nevertheless told me, though they felt a distress which they could

not

not describe, yet they could not say it was actual pain. The muscles during the disease are never compleat-
-ly relaxed yet, there is some remis-
-sion of the spasm, and at the same time, a mitigation of pain; but the least attempt to move, or speak, or even the slightest noise, will renew the spasm with accumulated force, and after repeated struggles a violent convulsion will sometimes seize upon the miserable victim and in an instant extinguish life.* The abdominal muscles are violently contracted in this disease, imparting to the fingers, a sensation, similar to that of feeling a board.

A costive state of the bowels al-
-ways accompanies tetanus.

When the disease arises from cold al-

* Sudden death in one of these paroxysms is thought to be occasioned by a spasm of the glottis, as in Hydrophobia &c, closing it and destroying life by suffocation.

alternating with heat, a fever of the inflammatory kind, in some cases, is present, but when it arises from wounds, doctor Hillary says he never yet observed any fever to attend it, In this state the blood vessels appear to be affected, only during a paroxysm; the pulse being contracted, hurried, and irregular: and the respiration is affected in like manner; but they return to their natural state, with a relaxation of the muscles.*

Doctor Cullen tells us that the heat of the body is not increased, but the face is pale with a cold sweat upon it, and very often the extremities are cold, with cold ~~with cold~~ sweats over them.

And doctor Girdlestone says that the disease was accompanied in Indies with insatiable thirst: the tongue

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* Cullen, Moseley, Hillary

tongue was whitish but never dry; vomitings became almost incessant, and the spasms, cold sweats, and thirst increased with the vomiting; which last if not checked; soon terminated the existence of the patient.

In forming our opinion with respect to the termination of tetanus; we are to be governed, by the cause, the violence, and duration of the disease. Tetanus, when it is brought on by heat, alternating with cold is not so fatal, as when induced by wounds. After the fifth day, the danger is not so great as on the preceding days, but the disease has terminated fatally even after the thirtieth day. Doctor Girdlestone says there is no immediate danger, be the spasms ever so general if the extremities possess warmth; on the contrary if there be coldness with the

the most trifling spasms there is danger.

A heat in the skin especially if preceded by rigor, doctor Moseley says is always favorable. This disease so terrible in its symptoms, so rapid in its progress, and fatal in its termination; is frequently produced by the slightest causes.

"I never knew," says doctor Moseley, "one case from the severest flogging in Military punishment; no pain however excruciating, excited on the surface of the body from the greater sensibility of the skin is capable of producing it, but I have known many instances where it has been caused by a slight lacerated wound on a finger or a toe, and I have seen it caused by irritation where no considerable branch of a nerve was near the part."

In fact that species which writers have termed symptomatic and consider as most fatal, is oftener induced from

from punctures in the soles of the feet, hands, and tendinous parts, with nails splints &c; than from causes more allarming and terrible in their appearance; which should teach us to pay strict attention to wounds, of this description in warm seasons and particularly in irritable habits.

A wound from the thorn of an orange tree so small that it could scarcely be observed, has produced tetanus.* It has been caused, by the stroke of a whip on the arm, when the skin was only broken. And an abrasion of the skin of one of the toes by wearing a tight shoe has induced it.† It has been produced by venesection; and by cutting a corn on the toe.‖ A wound of the tongue,

brought

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* Chalmers. † Rush. ‖ ib

brought it on. It also arose from a fish bone sticking in the throat.[†] The extraction of a tooth gave rise to it, in a man in the Pennsylvania Hos-pital.[*] It has followed the bite of certain serpents.[‖] And the sting of a wasp upon the glands penis has caused it.[‡] Women in the West Indies have been attacked with it during parturition.[a] Doctor Wright mentions a case which occured in consequence of a stroke of the sun.[b] Doctor Rush relates a case of tetanus in a soldier, who was sentenced to be shot, and at the moment of execution was pardoned, but was unable to rise, from an attack of the disease induced by terror. Surgical operations in the West Indies are frequently rendered fatal

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† Hillary
* See a paper by Dr Rush in the Med. Commentaries Vol 19th.
‖ Dr Bartons M.S lectures.
‡ Clark.
a. Hillary
b Lond. Med. Obs. Vol 6

fatal, in consequence of the system being so liable to take on this spasmodic affection. Gun shot wounds, very often induce tetanus. The frequency of the disease from this cause, is no doubt owing to the debility brought on by fatigue, and the unavoidable exposure of the wounded oftentimes to the night air and cold damp ground.

Tetanus is also a symptom of Hysteria, Gout, Hydrophobia, and Bilious fever.*

In the East Indies, and particularly along the coast of Coromandel, the disease appears to be more frequent than in any place that we are yet acquainted with. Three hundred soldiers, doctor Gridlestone informs us, were attacked with spasms in the first month of their arrival at Madras.+ Its frequency among foreigners

* Doctor Rush, Millar, Clark &c

+ Gridlestone on the Spasmodic affections of India

foreigners, he ascribes to the use of coffee made of the Stramonium. Bad arack or spirit. And particularly among the new comers, the non use of capsicum or strong pepper in their food. Also to the drinking of cold water immediately after intoxication. And also the damps from the earth, which is so deleterious as to kill the fowls which roost near the ground. But he considers sudden exposure to cold after the body is much heated, as the most certain, speedy, and frequent cause of the disease, in India. And perhaps to this alone, we might refer three fourths of all the cases that happen; most writers who have professedly written upon the subject speak of it as a very common cause. Officers as well as privates doctor Girdlestone informs us, have been suddenly killed by spasm, brought on by carelessly

carelessly exposing themselves to the winds, with nothing on but their shirts, when wet with perspiration. An officer he says was seized with spasm immediately after bathing in cold water after a hard days march, And a Mussulman having used the cold bath, immediately after Coition, was seized with an universal spasm, and died in less than half an hour! The trismus nascentium, Jaw-fall or tetanus of Infants, is very fatal and is not confined to warm climates, for it prevails to a considerable degree in some parts of France, Switz-erland, and the highlands of Scotland. Doctor Hillary says it never makes its appearance after the ninth day of the childs age. It may be prevented in its forming stage by purges, Clysters, the warm bath, laudanum &c. But when formed I beleive its has never submitted to any mode of treatment whatsoever. It is ascribed to

various

+ In a punctured wound if great pain and convulsions should supervene: immediately make a free incision and enlarge it. The good ter

various causes, such as cutting the umbilical cord, with dull instruments, to a retention of the meconium, and also to the heat and smoke of the huts, in which those children are born. Doctors Hillary, Clark, and others ascribe it to this last cause in the West Indies, for they assure us that the white children are exempt as well as the free blacks, who are better accomodated: And on plantations where proper houses are established for lying in Women, the disease is scarcely known.

Tetanus though so unmanageable when compleatly formed is certainly very frequently prevented by remedies timeously applied, and we should immediately resort to them on the first appearance of any of the symptoms threatning the disease, after the causes liable to produce it.+ The good effect of this was clearly demonstrated in

in the case of a Lady who punctured her thumb with a needle, she was immediately seized with convulsions so strong as to require several men to hold her; Doctor Physick dilated the puncture and she was instantly relieved. The same operation was attended with like happy effects in a boy, whose foot was punctured by a nail.* A speedy suppuration is desirable in all wounds of this nature; lep danger is to be apprehended, after it takes place, and it should be promoted by applying lint, dipped in spirits of turpentine. Cantharides have been used for this purpose. A mixture of lime juice, and salt, is a common application in the West Indies, to wounds, and is spoken of in the highest terms.

The

* Doctor Physicks M.S. lectures

The fatal termination of Surgical operations in the West Indies, in consequence of tetanus, has induced many of the practitioners in these Islands, to treat the patient in every case with a view to this dreadful com-plaint. Doctor Moseley says that he never saved a patient who had a compleat tetanus, after an operation. But he thinks he has prevented many by giving bark as soon as possible after every operation, with anodynes every night, and attending to the state of the bowels. In fractures of the scull he says the best securities are frequent bleedings, occasional purges, and an extremely low diet. The prophylactic virtue of Mercury in tetanus is so highly spoken of, by doctor James Clark, that the importance of his facts will excuse me for transcribing his obser-vations at length. He says "as I found, from sad experience that

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I could never cure this very dreadful disease; I thought of trying some method of preventing it. It occured to me, that probably owing to its very rapid progress, there was not time to throw a sufficient quantity of Mercury into the system, to cure or overcome the great irritability or tendency to violent spasmodic contractions in the muscular fibres. And as Mercury seems to act as a powerful, antispasmodic in some diseases, I was disposed to give it a fair trial after accidents and operations, to prevent tetanus knowing of no other remedy so likely to produce that happy effect. After wounds or punctures, I therefore gave two or three grains of Calomel twice a day, and dressed the part with Mercurial ointment, from the day there accidents happened until a gentle salivation came on, and after

Operations

operations I gave three grains of Calomel every night with a grain and a half of opium, and three or four doses of bark in the day time, without regard to the symptomatic fever, till the mercury affected the mouth, which was generally the seventh or eighth day, when I gave the Calomel every second night only, and continued the Opiate and bark after the fifteenth day, when all was laid aside but anodynes. When the mercury did not begin to affect the mouth the seventh day I ordered some mercurial ointment to be applied over part of the stump, which seldom failed to bring it on.

Out of fifteen patients, after amputations treated in this way, only one died; and he was in such an irritable state before the operation that I dreaded the consequence, and was averse to its being performed. He was

was seized with symptoms of the tetanus the eighth day and died the ninth at night". He says that as far as he had opportunities of observing; the proportion of persons who recovered by this method after operations in the West Indies, is nearly three to one more than by the common method of treatment. In private practice he says he lost only two out of a great number of those who had been wounded or punctured.

Having now given the history, symptoms, and spoken of the remedies for preventing tetanus; we shall previous to entering upon the method of cure inquire into the true seat of the disease, and the source from which the muscles derive their irritability or power. This may be one step towards explaining the cause, why such various success attends the exhibition of the remedies used in the cure of this dis-
-ease. From a view of the

symptoms

symptoms we must be satisfied that the immediate seat of tetanus is in the muscular fibre.*

The muscles are endowed with a property peculiar to themselves, which is called irritability or contractility. Is this property inherent? Does it depend, upon their connexion, with the brain and nerves, or is it derived from another source? Various opinions have divided the greatest physiologists of latter days upon these points. The illustrious Haller supposes, the irritability of the muscular fibre to be an innate principle, peculiar to the nature, and structure, of muscular fibre, and having no connection with sensibility. Others believe the muscular fibre to be so much inanimate matter, deprived of the vis nervea. But little attention however was paid by most of these experimentalists to the blood vessels as they

* see Rush's enquiries & Obs. Vol 1

they considered them as being destined merely to furnish the muscles, and other parts with nourishment. That they are entitled to a higher office in the animal oeconomy, viz. not only supporting the life but giving power to the muscular fibre, we shall endeavour to show hereafter. Doctor Monro, after making a great number of experiments upon frogs by means of opium, concludes that "some of the phenomena of Muscular irritability could not be accounted for solely upon the principle of nervous influence" and he concluded "that the arteries were some how or other necessary to give vigour to the nerves of the part, so as to fit them to convey impression." Doctor Whytt concludes from his experiments upon Animals with opium, That the irritability or power of motion when stimulated proceeds from the nerves or at least is immediately dependent on their influence because opium

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which produces its effects solely by affecting the nervous system, destroys those powers".

If the irritability of the muscular fibre be derived from, and, depend altogether upon the nervous influence, how are we to account for the fact, that certain poisons when applied to the blood, shall in an instant, as it were, destroy the irritability of the muscles; and cause the death of the whole system; but if applied to the nerves, they will act with impunity. Here then we see that a stimulus may be conveyed to the muscle by a route very different from that of the nerves, and immediately destroy their irritability or power of motion.

That the irritability of the muscular fibre does not depend upon the nerves, is further proven, by the fact, that contractions will take place in the fibrous part of the blood when submitted to the galvanic influence. And the experiments of the immortal John Hunter, show

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that the contact of nerve is not necessary to the contractility of the muscular fibre.

A peice of muscle was cut from an Ox immediately after being knocked down; after being frozen, it was two inches in length. Six hours after; being thawed, it contracted so as to measure only one inch. A portion of blood was exposed to the same freezing mixture, and froze before it could coagulate; and when thawed; it coagulated, or contracted, in the same manner that the muscle did.

Here we see that the lympt possesses the same kind of life or power as the muscle, and who can suppose it derives it from the Brain or nerves.

The blood does not coagulate neither do the muscles contract in subjects killed by the electric fluid, And we observe the same mutual law, governing both, in death from violent blows on the stomach. Animals that are run

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to death are found to have their blood disolved, and their muscles flaccid; and incapable of being excited by the strongest stimuli.

I have related these facts to show that the fibrous part of the blood, and the muscles exhibit the same phenomena of life. I think it rea-
-sonable to conclude therefore that they both derive it from the same source, this cannot be from the Brain and nerves. Nor can irritability be an inherent principle, for the muscular fibres are sometimes nearly in a state of exhaustion, and must receive a renewal of their power from some source, which I believe to be the blood. The experiments of the ingeneous Mr Fowler I think are so conclusive upon this point, that little doubt can rest upon the mind of any one.

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for the purposes of this dissertation it is not necessary to inquire what principle in the blood furnishes the matter -

I will detail a few of them in support of this doctrine.

He "laid bare both the crural arteries of a full grown frog, one of them was tied. The leg in which this was done became instantly weaker than the other, and rather dragged when the animal was put into the water. The frog, however, could still jump about with great agility. Four hours after this operation it was killed by crushing its brain. It continued to move its legs spontaneously, when touched, during more than two days after this, and contractions were excitable by the applications of the metals for two days longer. Sometimes it appeared rather doubtful, which leg contracted most vigorously, but in general the leg in which the artery remained free did so, and contractions could be excited in it more than an hour after every means to excite them in

in the other had failed. In another experiment he passed ligatures round the crural arteries of two other frogs and one of them was suffered to live thirty six hours afterwards, before its head was crushed: the other four days. In these, the disproportion between the vigour and continuance of the contractions in the compared legs, was so much greater than in the preceding experiment, as to leave no doubt of the effects produced by tying an artery. The leg, whose artery had remained tied four days, never contracted near so strongly as its fellow, and contractions had ceased to be excitable in it, upwards of twenty hours before they had ceased in the leg, whose artery had not been tied. From these experiments he concludes that a much greater detriment to the condition of a limb upon which contraction depends,

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is induced by interupting its circulation, than by intercepting its communication with the Brain. In order that there might be no fallacy with regard to difference of age, strength &c of the Animals that these seperate experiments were performed upon he instituted the following.

The sciatic nerve of one leg was divided, and the crural artery of the other was tied in a large frog. Scarcely any blood was lost in doing either. Two days after this I strangled it. During the first 24 hours, the leg, in which the nerve had been divided, appeared to contract with most vigour; after this period, the difference between them became more doubtful; but the contractions were at no time stronger in the leg, whose artery was tied, than in that whose nerve was divided.

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In another experiment he "tied the crural artery on one side, and divid-
-ed the sciatic nerve on the other, on three full grown male frogs. He strangled them all on the sixth day following. My motive (he says) for killing the frogs, subjected to such experiments, either in this manner or by crushing their heads, will be obvious. It was of consequence to pre-
-serve their circulation as entire as pos-
-sible, and, at the same time, avoid the continuance of pain, which by exhausting all the parts of the body, whose communication with the brain was not interrupted, might consi
-derably have affected the result of the experiments. The contractions excited by means of the metals were in all these instances likewise as much more strong and durable in the legs whose nerves had been divided

divided, than what they were in the legs, whose arteries had been tied as what I had found them to be in the preceding experiments. Having thus found that a diminution of the circulation of a part, was accompanied with a proportional diminution of the respective powers of the nerves and muscles in that part.

I next proceeded to examine if an increased circulation would be attended with a proportionable increase of these powers. I have observed that if a living and entire frog be set upon a plate of Zinc, contractions can very seldom be produced in any part of its body by passing a rod of silver over it so that the silver, the frog and the Zinc may be all in contact with each other. But I have found in upwards of twenty experiments, that when inflammation had been excited in one of the hind legs of a frog, by

irritating

irritating it with a brush contractions uniformly took place in that leg when the metals were applied to it, although none had been produced in it before it was inflamed, nor could still be produced in the other leg which remained in its natural state."

We see from these experiments of Mr Fowler, that in proportion to the quantity of blood sent to the parts, so is the irritability increased: and on the other hand professor Blumenbach says "that no steady proportional relation is observed to exist between the degree of irritability, in any part of the body, and the quantity of nerves with which it is supplied".

Although it appears very evident that the powers, in the muscles to contract does not depend upon the nerves.

It is not equally certain that the nerves are not the medium through which

which impressions are made on the muscular fibre in producing convulsions. The subject is yet involved in much obscurity. Many facts however might be pointed out to show that the muscles may take on violent, and excessive morbid action, independently of the nerves or their influences. That this is the case in tetanus I infer 1st Because the pain, is not in proportion to the force of excitement, now doctor Wright says that sensibility always bears a proportion to irritability, yet in some cases of violent opisthotonos no pain is felt. 2nly Because the whole of the senses remain unimpaired until near the last struggles of the expiring victim.

3ly Because tetanus has frequently su--pervened to wounds, when there was neither, pain nor uneasiness in the part; - and very frequently when the wound has been entirely healed.

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The high state of excitement of the Muscular fibres in tetanus is such, that not only the power of the will is unequal to restore order, but the strongest stimuli act with impunity. The first indication in the cure of tetanus therefore is to reduce the excitement of the muscles in order that the remedies hereafter recommended in this disease may act with greater certainty and success.

And if the theory of irritability advocated in this dissertation be correct; no remedy appears so well calculated to lessen excessive action in the muscular system as blood letting. This has often been confirmed in reduction of luxated bones and in parturition. In the former where the most powerful extension had been used in vain to overcome the contraction of the muscles; blood being drawn ad deliquium Animi, has in a moment suspended the power of the muscles, and the bone has been

replaced

replaced directly. And for numerous and interesting cases of obstinate labours which have speedily and happily terminated by drawing blood in the same way, with a view to relax the muscular fibres of the uterus, I refer to the inaugu-
-ral dissertations of doctors Miller and Dewees of this City.

Copious blood letting has been long practised in convulsions, brought on by various causes. And we have every reason to believe that tetanus is the highest grade of convulsion. Do cold, punctures, parturition, fear and Hysteria, produce convulsions; They have also been the most frequent causes of tetanus. "The Opisthotonos, and tetany, which seize young children in the West Indies;" doctor Hillary tells us, "arises from the same causes which usually produces the Insultus Epilepticus, or Convulsions in them in

England

England bef. a retention of the Meconium &c which irritates their bowels and so produces startings and convulsive spasms with all the other symptoms which precede and accompany convulsions in young children in England, and shews how much more readily and easily the nerves are affected and irritated in that warm climate and the tetany produced from a much less cause there than it is in England."

The similarity of symptoms is also very pointedly shown by doctor Denman when speaking of puerperal, convulsions, he says, "from the moment convulsions come on the patients often lose all power of swallowing, even in the intervals, and we are compelled to relinquish internal medicine altogether; and the exhibition of opium, oil of amber, the fetid gums or other medicine of that kind in form of Clyster before the birth of the child has never produced any good, and sometimes they have increased

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the irritability". If then convulsions and tetanus are only different grades of the same disease, I see no possible objection to resorting to the same powerful counteracting remedies, to cure the one that we so frequently observe to be servicable in the other. Doctor Hamilton advises, when convulsions occur during labour to bleed copiously. He says, "he knew two instances of the fits which had been suspended for some hours, recurring in consequence of the flooding being stopped, and in both cases the convulsions were removed by allowing the discharge to return".* And doctor Denman mentions a case of puerperal convulsions for which the late doctor Bromfield "had bled the patient without much benifit, In the violence of one of her struggles the orifice opened and a considerable

* Annals of Med.ne for 1800 Vol 5

considerable quantity of blood was lost before the accident was discovered, but the convulsions from that time ceased". Many cases of this kind might be related all tending to show how safe and effectual large bleedings are in violent convulsions and spasm.

Tetanus being most frequent in tropical climates, and in warm weather is thought to be a disease of extreme debility and therefore to forbid depletion. But we know that in most cases the predisposing debility in tetanus is induced by an excess and not a defficiency of stimulus. "The relaxation and debility of the body in warm climates," doctor Rush obsewes "has not been understood till lately to be of the indirect kind; of course instead of forbidding, it requires depletion to remove it". The blood drawn in tetanus exhibits all the marks of violent excitement, which strongly calls for venesection.

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It is always of a loose texture, and in death; dissections have shown that the blood is compleatly disolved, as is the case in many other diseases of violent action.* Even the appearance of disolved blood, should not deter us from

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* In the case of a boy who died of tetanus in the Pennsylvania Hospital. Doctor Coxe observed on dissection; "That the thoracic viscera were sound, except the heart, which appeared to be smaller than usual, and to be still under the influence of that spasmodic action which existed so powerfully in his last moments. The carnæ columnæ especially appeared to be permanently rigid, with none of that flaccidity, which might have been expected so long after death had taken place. The blood was not in coagula, but disolved like molasses, as in animals killed by lightning, appearing to indicate, that the whole muscular fibres of the arterial system had partaken of the general spasmodic action." He makes the following ingenious observations. "As all the muscles partake of

from abstracting it in diseases of violent excitement, if there be any thing in the pulse to show that the powers of life are not almost intirely exhausted.

Doctor

"of the spasmodic action of this disease, even the bladder, intestines and heart, may we not reasonably conclude, that the arteries partake in common of the same state, in a greater or less degree? Will not this state of the arteries, account for the apparently weak, and quick pulse, which is common in tetanus, and which is seldom excited to febrile action and fulness, even by the largest doses of wine and laudanum? And may we not hence also explain the great tendency to solution of the blood, which is noticed in this disease? What would be the effect of bleeding in small quantities, and gradually increasing the quantity drawn, in removing this spasmodic state? Would not a vigorous action of the vessels be thereby excited, and an inflammatory crust be produced on the blood; as has been observed in some very malignant cases of fever, where the depressed pulse and dissolved blood have gradually given way to violent action and sizy blood, requiring a continuance of the use of the lancet with greater freedom to subdue this more active, though less dangerous state of fever."

Doctor Rush relates a case of pleurisy in a gentlemen, whose blood was disolved; "the continuance of a tense pulse however, induced" him "to repeat the bleeding. The blood was now sizy, a third bleeding was prescribed, and the patient recovered".*

Most practitioners speak of blood letting, as a remedy in tetanus, but they prescribe it only, in certain cases. Doctor Hillary only advises us to take some blood in those cases that are plethoric; And doctor Chalmers, to whom we are in-debted for an excellent history of the disease, recommends bleeding to the begin-ning of the second stage, where the patient is plethoric, they will then, he says, "bear the warm bath and opiates better, from the use of which their reco-very is wholly to be expected"

The spanish physicians in the West Indies, bleed their patients, when plethoric in

* Medical Inquiries & Observations Vol 3 p 70

in both arms and legs; they then administer tonics, and scarify the body, along the course of the spine, and apply the juice of the American Aloe (Coratoa) to the part with a view to excite inflammation.* I am induced to believe that we should be more succesful in the treatment of tetanus, were we to prescribe blood letting as a general remedy in the first stage of the disease and in such quantities as to weaken the power of the muscles to take on spasmodic contractions, and not merely with a view to lessen febrile action or to remove plethora.

The labourers in brick yards who are much exposed to a hot sun, while at the same time they are working in cold wet clay, are very subject to cramps.

During the last summer, I was called to two persons of this description, and found them convulsed in a violent manner: The least exertion, would excite the muscles of the

* Moseley on diseases of Tropical climates

the legs, thighs, arms and abdomen; to powerful contractions, attended with great pain.

In both cases I bled immediately, until syncope was induced, The spasms returned but slightly, and were compleatly removed, by a small quantity of laudanum and Ether, and in three days they returned to their ordinary work.

By lepening the excitement of the Muscles in the way we have proposed bitz. blood letting, we prepare the system to be acted upon by other remedies, which have been long used in the cure of tetanus. And the first of these remedies that we shall speak of is mercury; this has been strongly spoken of as a preventive, and numerous cases of tetanus are on record in which the most perfect cures have been effected by the use of mercury alone.

But the rapid progres of the disease together with the high state of excitement, has so often prevented the system from being affected by it; that like other remedies it

it has fallen into disrepute. Doctor Moseley even says, "that mercury used in tetanus has killed more people, than it has cured, and those who recovered, when this remedy was used, would have recovered without it." There are very few, I hope that will join doctor Moseley in such an opinion. In those cases where the mercury has been capable of producing its effects; the uniform disapearance of the spasm and convulsions the instant the mouth was affected, shows very clearly, that these cures have depended altogether on the powers of the medicine.

The length of time required however, and the difficulty in exciting a salivation in this disease has detered many from useing it, this is certainly a very strong objection to a reliance altogether upon it, in tetanus. If by any means we could excite the mercurial action in a shorter space of time than is generally

required

required, I think that no remedy would be found so generally useful. Doctor Chisholm has found, mercurial ointment; or calomel suspended in a mucilage of gum Arabic, injected into the lower bowels of much advantage in exciting the system in yellow fever. He also speaks of strong mercurial ointment applied to blistered surfaces as being serviceable; my fellow graduate Mr Smith assures me that he made use of the ointment in this way in the malignant fever of Batavia with the effect of producing ptyalism in very short space of time. It should be tried in tetanus, But as some hours would be lost by waiting for blisters to remove the cuticle, and the impos-
-sibility oftentimes, to excite the heart action upon the surface by them, in this disease, we should use somthing more powerful. By the application of boiling water to the arms, thighs and legs, blisters might be raised

in

in an instant, with but momentary pain. Was it even applied simply to excite an action on the surface, we might expect to derive great advantages from it.

The good effects resulting from the warm bath, rubifacients &c in convulsions show the sympathy existing between the skin and muscles. In tetanus a heat upon the surface has been particularly noticed as a favourable symptom. Doctor Gridlestone says he never saw the case prove mortal however universal the spasms were if there was sufficient warmth upon the surface for the skin to absorb mercury, or to be made red by blisters or other stimulating applications.

There can be no objection to the use of other remedies at the same time, that we are using mercury.

Peruvian bark and wine were used, in conjunction with mercury, in the case

case of a Sailor in the Pennsylvania Hospital until a salivation was induced and the patient was compleatly cured. Doctor Rush, thinks that the bark and wine in this case prolonged life until the mercury took effect. He has used the bark alone, successfully in the cure of tetanus, and it is highly spoken of by other gentlemen.

Wine has been employed with happy effect in many instances. Doctor Hosack of New York, administered it with success in two cases. To one patient; in the forming state of the disease he gave a large wine glass-full every hour until the pain of his wound was removed.

In the other case brought on by a wound in the wrist, he gave the patient two ounces of Madeira wine every hour until she had taken three gallons, and compleatly

cured

cured her, He is of opinion that the wine is sufficient, and thinks that no benefit is derived from the use of any other medicine with it in this disease.* A quarter cask of Madiera wine Dr Currie tells us, was consumed by one patient in the infirmary of Liverpool, with the effect of curing him.

Opium has always been considered of the first importance, in the treatment of tetanus. Melancholy experience however, has too often shown, what little dependance is to be placed on it alone. Fifteen hundred grains of it were given to a patient in the course of seventeen days, during which time he slept very little.+ Doctor Chalmers considers the warm bath and opiates, to be the most effectual remedies in this disease.

In two cases of tetanus from gun shot wounds

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* Annals of Med. 1799

\+ Transactions of the Amer. Philos. Society, Vol 1.

wounds, Dr Stutz has succesfully employed, opium and vegetable alkali internally. He used at the same time a warm bath, made of the ley of wood ashes, in which two ounces of caustic potash were disolved. The patient when placed in this bath felt immediate relief and was able to move his limbs. One drachm of the vegetable alkali, was disolved in six ounces of water, and sweetned. The patient had been using mercurial ointment which was omitted, and a table spoonful of the mixture was given every two hours, and his Opium was diminished to ten grains a day. A Clyster was administered daily which brought away some hardened fæces. This treatment was continued ten days, during which time, he took one drachm of alkali daily, but the opium was reduced to two grains,

and

and the alkali was gradually diminished as the symptoms subsided, and finally left off when the patient recovered.*

The Warm and cold baths have been recommended in this disease. Doctor Wright of Jamaica has cured a number of cases of tetanus by dashing cold water over his patients.+

Doctor Rush, has used it with success in one case. "The signals for continuing the use of the cold bath, he observes are its being followed by a slight degree of fever, and a general warmth of the skin." In India the same happy result has not followed its use. Dr Gindlestone informs us that scarce any patient could survive two minutes after coming out of the cold bath. The warm bath was useful, and when it could not be had, he gave repeated injections of

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* Annals of Medicine Vol 5 for 1800
+ Lond. Med. Obs. Vol 5.

injections of warm broth with about thirty drops of laudanum, using at the same time frictions with hot flannels, and warm cordial draughts with laudanum, until the reachings had ceased, and he thinks that he succeeded better with this plan, than with the warm bath, because, those relieved by the injections were not so apt to relapse as those relieved by the warm bath. The oil of amber given in doses of six or eight drops every two hours in tetanus, doctor Rush says has produced the happiest effects.

Electricity has been employed with succeß in a case of four months continuance, after all other remedies had been tried in vain.*

The tincture of Cantharides has been exhibited internally in order to excite in-

* Lond. Med. Museum Vol 2.

inflammation of the stomach and bowels. This bold and ingeneous practice was first sugested and tried with succes in a case of tetanus, by Dr Brown of Kentucky.* It has however failed in several other cases, where considerable quantities of the tincture had been given.

Stramonium. This was given by Dr Hartshorn late house Surgeon of the Pennsylvania Hospital, to an out patient of that institution, who had tetanus in consequence of a wound on the foot. The tincture of bark Opium, and mercury were tried without effect, three grains of the extract of Stramonium was given, and ordered to be repeated every 3 hours. In one hour after taking the first dose, the spasms left her intirely, and she recovered perfectly.

I shall

* New York Med. Repos. Vol 4th.

I shall conclude by observing with Dr Rush that. "In order to ensure the utmost benefit from the use of the above remedies, it will be necessary for a physician always to recollect, that the disease is attended with great morbid action, and of course each of the stimulating medicines that has been mentioned should be given, 1st in large doses; 2ly in succession; 3ly in rotation; and 4ly by way of glyster, as well as by the mouth."

finis.